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# POST-DIPHTHERITIC PARALYSIS OF THE EXTERNAL RECTI; WITH A CASE.

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[Read before the College of Physicians of Philadelphia, April 16th, 1892.]

Paralysis of accommodation, or cycloplegia without alteration of the condition of the iris (mydriasis), is often seen after diphtheria, and is the most constant affection of the internal ocular muscles which occurs as a sequel of this disease. Usually bilateral, the cycloplegia is rarely complete, but when it is there may be mydriasis. There is, however, considerable diversity of expression concerning the state of the pupil under these circumstances. Sphincter palsy has been recorded by Weber[1] and by Donders[2]; sphincter paresis by Schaeby-Buch[3], and Abercrombie[4] among eighteen cases found the pupil dilated and sluggish in all. Other observers regard the affection of the pupil as comparatively rare, and for the most are in accord that there is generally an absence of pupil-symptoms.

Just as palsy and paresis of the ciliary muscle are frequent, paralysis of the external ocular muscles is comparatively uncommon. Faure[5], among other visual disturbances, mentions strabismus once. Among ninety cases recorded by Maingault[6], thirty-nine had amblyopia and ten strabismus. Rumpp[7] speaks of paralysis of the internal recti muscles. Alfred Graefe[8] noted two cases, in one of which there was paralysis of the superior oblique, and in the other paralysis of the external recti. Remak[9], among one hundred cases of post-diphtheritic cycloplegia, found ten with paralysis of one or both external recti. Rosenmayer[10], among ten cases of post-diphtheritic cycloplegia, observed two with paresis of both external recti. Arthur H. Benson[11] records a case in which the levatores palpebrarum were affected in the ninth week

[1]Virchow's Archiv, Bd. 25 and 28.
[2]Accommodation and Refraction of the Eye. New Sydenham's Translations, 1864, p. 297.
[3]A. f. O. xvii, p. 265.
[4]Trans. International Medical Congress, 1881.
[5]L'Union Médicale, Nrs. 15 and 16, 1857; quoted by Donders, loc. cit.
[6]Nagel's Jahresbericht, 1871.
[7]Nagel's Jahresbericht, 1877, p. 381.
[8]G. u. S. Handbuch der gesammten Augenheilkunde, vi, p. 73.
[9]Centralblatt f. prakt. Augenheilkunde, 1886.
[10]Wien med. Wochenschr. No. 13, 1886.
[11]Trans. Oph. Soc. of the U. K., Vol. iii, p. 265, 1883.

after the throat lesion appeared, and during the same week the external recti were attacked, and there were convergent strabismus and diplopia. Gowers[1], speaking of the affections of the special senses in diphtheria, refers to the weakness of the internal recti which may be associated with the cycloplegia, and quotes Vadelot as authority for one case in which all the muscles supplied by one-third nerve were paralyzed. He has seen double ptosis and mentions the occasional phenomenon of slight paralysis of one or another of the ocular muscles, varying from day to day, and Pagenstecher[2] has observed in an epidemic of diphtheria, palsy of the external ocular muscles (recti and obliqui) characterized by rapid onset, interchange and disappearance, occurring in the convalescent stage. Recently A. Stanford Morton[3] has reported three cases of more or less complete bilateral paralysis of the external recti following diphtheria.

Several cases of paralysis of *all* of the ocular muscles after diphtheria have been published. This complication is exceedingly uncommon. Thus Uhthoff[4] records the case of a boy aged 10, who had been treated for a mild attack of diphtheria from September 1st to September 17th, 1883. Toward the end of September he was unable to read. On October 6th, there was paralysis of accommodation, and on October 16th, complete external ophthalmoplegia. Mendel[5] describes a case which terminated fatally in a boy aged 8. Diphtheria of moderate severity was present from September 22d to September 28th, 1883. On October 4th there was paralysis of the palate; on November 2d, visual disturbance and weakness of all four extremeties; and on November 5th, double ptosis, most marked on the right side, paresis of the external rectus, paralysis of the internal rectus, with paresis of the superior and inferior recti. On the left side there was paresis of all of the recti muscles. There was no paralysis of accommodation or limitation of the visual field. On November 11th, ten days after the onset of the ocular paralysis, the patient died. Evetsky[6] published the case of a girl aged 8, who had complete bilateral ptosis, abolition of the upward and downward movements of the eyes, limited lateral movement, no loss of accommodation and normal visual fields and color-sense. Two weeks previously the child had had a sore throat with painful deglutition.

To the cases of paralysis of the external rectus muscle which have been recorded, I desire to add the following example, which occurred

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[1]Diseases of the Nervous System, 1888, p. 1223.
[2]Monatsbl. f. Augenheilkunde, Jahrgang 64, p. 358, quoted by A. Graefe, loc. cit.
[3]Trans. of the Ophthalmological Soc. of the U. K., Vol. xi, 1891, p. 106.
[4]Neurolog. Centralbl. 1885, No. 6, p. 125.
[5]Ibid, 1885, No 6, p. 128.
[6]Arch. d'Ophtal. November and December, 1887.

in the service of Dr. Weir Mitchell, in the Infirmary for Nervous Diseases, and by whose kind permission I publish it.

Florence B., aged 4½ years, was brought for treatment January 8th, 1892. The following record was made by Dr. Joseph Leidy: The patient when four months of age, had an illness which was diagnosticated as spinal meningitis, the diagnosis being based upon the following symptoms: Retracted head, bulging on the top, and a cephalic cry, with fever. There were no permanent lesions after this attack. Six weeks before the date of her visit, the child contracted diphtheria, from which she made a slow recovery. Three weeks after the diphtheritic attack, the following symptoms were noted: Ptosis, irregularity of the pupils, the right being larger than the left, and weakness of the right and left external recti muscles. The child regurgitated liquid food; there was difficulty in swallowing; the speech was indistinct; hearing and taste were unimpaired; there was tremor of the hands and arms, and muscular weakness of the extremities. She is now unable to walk or stand, or at least indisposed to attempt to do this; knee-jerk absent; no ankle clonus; no incoordination of the hands. The child is nervous, irritable, and cries out frequently during sleep. The appetite is fair, the tongue clean, the bowels regular. The lungs are normal, and there is paralysis of the palate, as before noted, liquid foods being regurgitated. The heart's action is rapid, the pulse 120, but there is no murmur.

I made an examination of the eyes with the following result: There is convergent strabismus, the right eye "fixing;" the lateral movements are diminished, the left eye failing to move past the median line to the left, and the right not passing to the external commissure. The vertical movements are unimpaired. Attempts to demonstrate diplopia were not satisfactory, but it probably was present, and, as far as I could judge, there was false projection of the field of vision. The pupils were unequal, and facing a bright light the right measured 5 *mm.* and the left 3 *mm.*; their reaction to light and to convergence was unimpaired. There was slight ptosis of the left eye, the upper lid upon that side drooping a little lower down than that of the right, causing a narrowing of the left palpebral fissure of one-sixteenth of an inch. Rough tests seemed to show that there was paralysis of the ciliary muscles. The suggestion of Dr. Edward Jackson to employ the shadow-test to elicit this point was thought of, but it was impracticable to utilize it on account of the extreme restlessness and irritability of the child; indeed, at this time all of the examinations were very difficult. Ophthalmoscopically there were no changes of importance. Each optic disc was a vertical oval, rather pallid, and the retinal veins a little fuller than normal. The patient was ordered an elixir of quinine, iron and strychnia, Faradism for the lower extremities, massage and rest in bed.

Three days later, or on January 15th, 1892, she was admitted to the Hospital, and the ocular conditions were then as follows: Right pupil 4 *mm.*, left 3 *mm.*; ptosis as before; the right eye now moves to the external commissure; in the left eye the limitation of movement remains; there is still slight convergent strabismus and the child fixes, by preference, with the right eye; the pupils react normally.

The child was placed in bed, a pill of the sulphate of strychnia gr. one-hundredth, three times a day was ordered, together with general massage and Faradic electricity.

The following notes, made by the house doctor, Dr. Dean, are taken from Dr. Mitchell's case book.

January 25th, 1892. No regurgitation of liquids; no difficulty in swallowing; appetite good; speech much improved and words easily distinguished; no tremor of the arms and hands; disposition much improved; rarely cries, and is generally smiling and ready for conversation; cannot walk without support, being unable to place the feet in proper position, when in the recumbent posture, however, there is good control of the movements in all directions. She cannot overcome much force with the lower extremities. The hand-grasp is of fair strength and equal on both sides. Knee-jerk absent; tendo-Achilles jerk absent; plantar reflexes present; no clonus; elbow-jerk absent.

February 10th. Walks without assistance but gait faltering and unsteady; speech as good as other children at her age; appetite good; muscle power much improved in lower extremities; power of resistance in arms and forearms good; knee-jerk absent on both sides; reinforcement absent; tendo-Achilles jerk absent; plantar reflexes present; no clonus; elbow-jerk absent; no chin jerk.

March 11th I made the following record in regard to the eyes: Strabismus entirely absent; excursion of the eyes normal in all directions; pupils still slightly unequal, but their reactions normal in all particulars. The strabismus disappeared about one week after admission. The last examination, (March 18th, 1892) which has been made of this child reveals the following points: No strabismus; excursion of the eye-balls normal in all directions; width of the palpebral fissures equal; slight inequality of the pupils, the left being $\frac{1}{4}$ of a millimeter larger than the right; muscular power good and walks easily; knee-jerk, elbow-jerk and tendo-Achilles jerk still absent.

There are several points of interest in this case. 1. The order in which the paralytic symptoms appeared. It is difficult to state this accurately, but it seems likely that the throat affection lasted for about three weeks, that the soft palate, and probably at the same time the ciliary muscle, were affected in the fourth week, followed immediately by the ptosis or affection of the levator palpebræ. The strabismus is also placed in the same period, while somewhat later, probably in the sixth week, the weakness of the lower extremities began. In Benson's case the primary throat affection lasted four weeks, the ciliary muscles were affected in the fifth week, the soft palate in the sixth week, the hearing in the sixth week, the levatores palpebrarum and the external recti in the ninth week, and the weakness of the lower extremities in the tenth week.

2. The order in which recovery occurred: First the accommodation returned, and almost at the same time the weakness of the right external rectus muscle disappeared, that is, there was no difficulty in conjugate movement to the right; later and within a week the limitation of the movement to the left had disappeared. In close connection with this was the return of the child's natural disposition, which was pleasant and lovable. Following this came improvement in the lower extremities, so that six weeks after treatment she was able to walk

without assistance. The knee-jerk, as is usual in these cases, remains absent, and is probably the last of the functions to reappear. In connection with the order in which the ocular symptoms disappeared in this child, Uhthoff's case of complete paralysis of all of the ocular muscles is interesting. First the accommodation recovered; then the muscles engaged in certain associated movements, namely, the inferior recti, and the left external rectus and left internal rectus regained power. Then the superior recti recovered, and finally conjugate deviation to the right was possible.

3. The unilateral mydriasis: There was marked inequality of the pupils for more than a month, and even now, eleven weeks after the first pupillary phenomena were noted, there is slight difference in the diameter of the pupils. If it is true that mydriasis is more apt to occur when the cycloplegia is complete, it is probable that this may have been the condition on the right side, while on the left it was incomplete. At no time was there any imperfection in the mobility of the irides, either under the stimulus of light or convergence.

Although, this of necessity, is purely a clinical record of bilateral diphtheritic palsy of the external recti and incidental mention of the accompanying cycloplegia, it is worth while in closing, to refer briefly to our knowledge of the pathology of these cases. At the present time diphtheritic palsy is usually included among the acute nuclear palsies, but according to Dr. Gowers, although it is probable that diphtheritic cycloplegia is of nuclear origin, it is uncertain whether the paralysis of the orbital muscles, when it occurs, should be ascribed to nuclear or peripheral disease.

The history of the theories which have been advanced to explain diphtheritic paralysis in general is somewhat as follows: Charcot and Vulpian[1] attributed the palsy to an ascending neuritis from the local lesion. Buhl[2] ascribed the condition to vascular changes, capillary neuritis and exudations both in the brain and around the roots and ganglia of the spinal nerves. Déjerine[3] ascribed the cause of diphtheritic palsy to a sub-acute polio-myelitis involving the motor cells of the anterior horns and their homologous nuclei, with a secondary peripheral neuritis. Oertel and Klebs have found micro-organisms. Mendel, whose case of complete ophthalmoplegia externa came to post-mortem examination, believed the condition to be due to capillary hemorrhages (central), and a primary peripheral neuritis. Siemerling[4], in a superb research concerning chronic progressive paralysis of the ocular muscles, concludes that the local lesions found in chronic ophthalmoplegia justi-

[1] Compt. Rend. de la Soc. Biolog., 1862.
[2] Zeitschr. f. Biologie., 1867.
[3] Arch. de Physiologie, Norm. et Patholog., 1878, p. 107.
[4] Archiv. f. Psychiatrie und Nervenkrankheiten, Bd. 22, Suppl. Heft, 1891.

fy the following conclusions, namely, that there may be (1) Nuclear disease, (disappearance of the ganglion cells) with participation of the nerves to their termination in the muscles. (2.) Degeneration of the muscles and of the nerve trunks, with intact nuclei. (3.) Interruption of the conducting power of the intramedullary roots on account of sclerotic foci, with intact muscles, nerve trunks and nuclei. These conclusions, of course, do not refer especially to diphtheritic cases, but are interesting in this connection as an authorative statement in regard to the pathological condition which underlies progressive paralysis of the external ocular muscles.

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